

Notes on the Geography of Tau Ceti

Collected from the works "The Dispossessed" and "The Day Before the Revolution" by Ursula K. Le Guin

Anarres

General:

A dry, windy, cold and barren planet with little natural vegetation. There are no flowering plants and no insects. Imported fruit trees therefore need to be pollinated by hand, a labour intensive process. The only two notable native crops are the versatile *holum* and the pale *mene-grass*. Holum comes in a variety of forms, from ground-holum, to shrubs and trees. Holum is used for construction and fire-wood, and the roots and seeds are edible. The seeds can be ground to a flour for baking or fermented into a kind of wine. The holum fibres are used for paper and fabrics. The planet is pale, bluish-white and mottled dun, for the most part when viewed from orbit or from Urras.

There are only three phyla of animals on land, all nonchordates -- there are no large animals live on land and there is no bird life. But the marine life in the seas and oceans is abundant and varied. The fish stock is actively bred for higher productivity by Anarres' fish geneticists, though with caution and an utter respect for the ecological systems. The three major oceans have not been connected for millions of years, wherefore they each support their own unique fauna.

The Settlement of Anarres started in IX-771, after the Odonian rising, when the governance of the planet was handed over from the Urrasti Council of World Governments to the Odonian international. Over a period of twenty years, twelve ships shuttled a million settlers from Urras to Anarres. Today Anarres is home to approximately twenty million humans. Pravic, a language constructed by the Odonian settlers is virtually the only language used on Anarres, except for a few loan words, such as curses.

Anarres, despite being an anarchist society, maintains trade relations with the capitalist Urras through the Urrasti *Council of World Governments*. The main exports from Anarres are metall, for instance mercury, copper, aluminium, tin and gold. In exchange Urras offers refined products, such as petroleum products, delicate machinery and electronic components, as well as seeds and crops for the agronomists of Anarres to attempt cultivating.

Mathematics on Anarres generally makes use of the duodecimal system and each day is divided into twenty-four hours, but everyday life is still organised into ten day periods, called *decads*.

The axis of Anarres is tilted, like Earths, producing seasons. Midsummer is celebrated as *Insurrection Day* in remembrance of the first great uprising in Nio Essaia, in the year IX-740. Cooks and refectory workers are honored as the guests of the rest of the community on that day, because a syndicate of cooks and waiters began the strike that led to the insurrection.

Anarres is smaller than Urras and has a lower surface gravity, and consequently Anarresti are typically taller than Urrasti. Assuming that both planets have a similar composition, I estimate that the radius of Anarres is about two thirds that of Urras and consequently that the same holds for the surface gravity. I further estimate (see note at the back), that the surface gravity of Urras is about two thirds that of Earth, meaning that the surface gravity of Anarres would be approximately 0.44 g, slightly higher than that of Mars or Mercury (0.37 g for both). I assume that Urras and Anarres have the same origin, and hence similar densities, but since Tau Ceti is believed to be a mineral poor star, I assume the density of the planets to be slightly smaller than that of the Earth, and estimate that Anarres has a radius of 0.47 Earth radii.

Northwest:

The area between Abbenay and the Temanian sea in Southwest, under the Ne Theras, is the of the most fertile on Anarres, and the only place where grains from Urras can be cultivated with any great success. Urrasti scholars of old, who saw the reagon in their telescopes...

Places:

- Abbenay, the seat of the central administration of Anarres, and the largest city on the planet. It is located in the south east part of the Northwest region of Anarres, approximately 20 degrees north of the equator. The Port of Anarres, where space ships land, is north of the city. Abbenay, originally called Anarres Town, was the first city to be founded on Anarres back in IX-738. It was renamed Abbenay after the Odonian rising and the following Settlement in IX-771. Abbenay lies in the green lowlands beneath the Ne Theras. The area between the west Ne Theras and north western shores of the Temae is the most prominent green area of Anarres. This was recognised already in the II-hundreds by the astronomer priests Serdonou and Dhun, who named many of the geographical features of Anarres. They named the green area around Abbenay *Ans Hos*, meaning "The Garden of Mind". In pravic, the constructed language adopted by the Odonian settlers, *Abbenay* means "Mind". Due to its favourable climate, the *Plain of Abbenay* is the only area on Anarres where crops from Urras are cultivated with any great success. In the centre of the city five of the wide streets join on a triangular park -- called simply the *Triangle Park* -- where trees from Urras are cared for. The park also has a statue of Odo, sitting on a bench reading the proof of her book *The Social Organism*. Just after the settlement, Abbenay was home to about one hundred thousand people, now it has a population of perhaps half a million. The buildings are low, almost all but one story, and robust due to the frequency of earth quakes. The city has a vaguely cellular structure, where the same basic pattern is repeated for each neighbourhood. Transport is available through omnibusses. Abbenay is the location of many of Anarres central institutions, such as Production and Distribution Coordination, or PDC, as well as Divlab, the administration for the division of labour; Shevek worked at the *Central Institute of the Sciences* in Abbenay.
- Peace-and-Plenty, a community on the coast of the Sorruba sea, known for its fisheries and fish laboratories.
- Sorruba sea, the sea covering much of Anarres northern latitudes
- Ne Thera mountains; see Northeast.

Southwest:

There are no major bodies of water. Marshes from polar melt form in southern latitudes during the summer; near the equator there are just shallow, alkaline lakes and dry salt pans. There are no high mountains to speak of, just broken hills going north to south every hundred kilometers or so, striated in violet and red (like badlands in e.g. Utah, on Earth). It is a land of sand dunes and sand stone. Grey-green rockmoss grows in vertical lines on the rocks.

Places:

- Elbow, a community north of the mountains in Southwest, notable for its phosphate factories.
- Grand Valley, known for its phosphate factories.
- Sedep (Upper and Lower), known for its copper mines.
- Copper Mountain, the mountain where Sedep is located.
- Lonesome, a small isolated community 1700 km from Sedep by rail. Shevek hitches a ride with the Sedep-Lonesome train when returning to Abennay from Grand Valley.
- Portal, trains for Grand Valley pass through here.
- Tin Ore, a mining community. Shevek passes through on his way back to the Northsetting Regional Institute, after having planted trees in Southeast
- The Dust, the dry and barren area stretching from Southeast, through Southwest, and further into Southrising. In the previous geological era, The Dust was covered by great holum forests, today it is wide stretch of unforgiving desert. Its name comes from the fine grey dust which the dry soil gives up at the slightest provocation.
- Equator Hill, a community and interchange for trucks and trains. Approximately eighthundred kilometers south west of Abbenay. May also be in Northeast.

Southeast:

Places:

- The Dust, see Southwest
- Tamaenian sea. The eastern coasts on the Tamae are fertile and support many fishing and farming communities, but the naturally arable area is a mere strip along the sea. In the fifteenth decade, a major afforestation project was undertaken, where holum trees were planted in order to recapture some of the desert from "The Dust".
- Rolny, a sandy peninsula reaching into the north Tamaenian sea. The only settlements and activities on Rolny are devoted to the marine laboratories. A string of islands bridge the Tamae, reaching out from the south tip of Rolny and into Southrising. Since shipbuilding is prohibitively resource demanding on Anarres, they are mostly unpopulated.

Northeast:

Earthquakes are common in the Ne Theras, near Chakar.

Places:

- Ne Thera mountains, the large mountain range spanning nearly half the continent, from Northwest, through Northeast, to Northsetting. Prone to earth quakes. Scrub holum, the staple crop of Anarres, and the silvery moonthorn grow here. The mountain range is one of the few places where there is enough water for quick-running streams to form. This, and other "scenic" qualities, makes the mountains popular for hikers. Colloquially known as "the Ne Theras".
- The Round Valley, a small, isolated farming community in the Ne Theras. Takver, the partner to Shevek, grew up here.
- Chakar, a community in the Ne Theras, by Kidney Mountain.
- Kidney Mountain, a mountain in the Ne Theras. There is an airport on the mountain.
- Tamaenian sea. The northern coasts of the Tamae, west of Rolny, is called the Coast Barrens -- salty and unarable land.

- Sorruba sea
- Green mountains, a mountain range, part of the Ne Theras, where it rains as much as 1000 mm/year and where many plants are brought up before sent to planting projects. I speculate that it refers to the part of the Ne Theras immediately North and East of Abbenay, since this is the region mentioned as particularly fertile.
- Eastern Points, a community in the foothills of the Ne Theras. It is a good starting point for a hike in the mountains. There are cottages in the mountains, kept stocked and in shape by the Ne Thera Federative and other volunteers for the benefit of vacationers. Near to Eastern Points there is one such cottage, a stone lodge known as the Wayshelter. I speculate that the name refers to the eastern points of the Green Mountains, not of the entire Ne Thera mountain range, placing it to the North East of Abbenay.
- Harmony, a city on the Taemenian coast, just north of the equator. The coast west of Harmony, all the way to the Rolny peninsula approximately one thousand kilometers away, is swamps and salt marshes.
- Concord, a community with a regional institute or a large school. Might be near Harmony.
- Fresh Start. The name sounds like it is a city founded by the first Odonian settlers, wherefore I speculate that it is in Northeast, somewhere in the more fertile regions not too far from Abbenay.

Northsetting:

The Anarresti temporal physicist Shevek grew in this region.

Places:

- Ne Thera mountains; see Northeast
- Drum mountain
- Freedom
- Northsetting Regional Institute of the Noble and Material Sciences, where Shevek got his education
- Wide Plains, between the Ne Theras and the Temae. Shevek grew up here.
- Malennin, a city on the coast of the Temae
- Sea of ice, a sea mostly perpetually frozen
- Sorruba sea
- Taemanian sea; sea Southsetting, Southeast and Northeast

Southsetting:

Places:

- Segvina Island, a remote and isolated place where there is an Asylum for those who cannot live in the rest of society, due to mental illness, social incompatibility, or due to having committed some deed which makes them unwelcome -- such as rape or murder -- can request to be positioned for therapy. It exists as a refuge, and like everything else on Anarres going there is voluntary, though in practice the peer pressure can force individuals to go there.
- Sael sea, see Southrising.
- Taemanian sea. A string of islands bridge the Temae from Southsetting to Southeast. Since shipbuilding is prohibitively resource demanding on Anarres, they are mostly unpopulated.

Southrising:

Prior to the Odonian settlement, there were already mining communities in Southrising. Common ores were gold, tin and copper. The mining communities retain some of their pre-settlement customs, such as their own songs and holidays. Garnets and yellow diamonds are found here.

Places:

- Red Springs, a farming community.
- Green sea, an inland sea
- Sael sea, a large inland sea in Southrising. The south west part of the sea stretches ever so slightly into Southsetting.
- The Dust; see Southwest
- Taemanian sea; sea Southsetting, Southeast and Northeast
- Uttermost, a community that is remote in such a way that "from Abbenay to Uttermost" has the connotation of including the entire planet. In order to be as far as possible from Abbenay, it would be in Southsetting, but I'm inclined to believe the figure of speech measures remoteness in more symbolic manner, meaning that it is far and hard to get to. I therefore tentatively place it in Southrising, on the coast of the Sael sea, speculating that it might have been one of the original Thuvian settlements.

Northrising:

The region is known for its fruit orchards on the coast of the Keran sea, and conserved fruit and fruit juice are two major products from the region.

Places:

- Keran sea
- Sorruba sea

Urras

A green opal, a cloudy turquoise. Five sixths of the planet is covered by water. It's only deserts are the polar ice deserts.

Home to at least one billion humans in at least two dozen nations, the two major of which are A-lo and Thu, both located in the eastern hemisphere.

A popular recreational drug, at least among the lower classes on Urras, is *maera-gum*, likely similar to tobacco in its effects and potency. When chewed it promoted salivating, and hence users often spit.

Through the Urrasti *Council of World Governments*, Urras maintains a lucrative trade arrangement with its anarchist neighbour. The main imports from Anarres are metals, for instance mercury, copper, aluminium, tin and gold. In exchange Urras offers refined products, such as petroleum products, delicate machinery and electronic components, as well as seeds and crops for the agronomists of Anarres to attempt cultivating. The trade is made at a good profit margin, since metals, after the self-plundering years of the VII- and early IX-hundreds, are scarce on Urras.

Mathematics on Urras generally makes use of the decimal system and each day is divided into twenty hours.

I estimate (see note at the back), that the surface gravity of Urras is about two thirds that of Earth (0.67 g), almost twice that of Mars or Mercury (0.37 g for both), but much lower than Venus (0.9 g). Since Tau Ceti

is believed to be a mineral poor star, I assume the density of the planets to be slightly smaller than that of the Earth, and estimate that Urras has a radius of 0.71 Earth radii.

The axis is tilted, like Earths, producing seasons.

A-lo:

A nation in the Eastern Hemisphere. One of the two major powers on Urras. A capitalist regime, governed by the Senate under the Directors. The nation where Laia Asieo Odo, founder of the odonian movement, was born in IX-698. Most of the country appears to have a temperate climate, though it stretches from the tropics just south of the equator to 45 degrees north thereof. The nation shares its only land border with Thu, in the east.

Thu has coasts on North and Tiuve seas, and the south west part of the southern continent, south of Thu, across the Tiuve, may also be A-lo territory.

A-lo is a consistent patriarchy, where women are expected not to aspire to any intellectual positions or positions of power. Women customarily shave their heads, and a full set of hair is seen as indecent. The state religion of A-lo is devoted to the *Primal Harmony*, a belief based in part on numerology, which seems to also influence Anarresti thinking.

Places:

- Nio Essaia, capital of A-lo. A city with a population of five million, founded on the Sua Estuary. The light research and the nuclear research laboratories, the national archive, the national library, and the national bank. Space is at a premium in central Nio, as it is sometimes called, so there are no parks or green areas in the city centre, but the Old Palace Gardens give the inhabitants access to a green lung, complete with ponds for rowing. The Senate of A-lo governs from the Directorate, by the Capitol Square. Nio, as it is sometimes called, is located approximately 20 degrees north of the equator and appears to have a warm temperate climate, or maybe even sub-tropical, though the winters can bring snow in abundance. The most famous shopping street is Saemtenevia Prospect, which is more than three kilometers long. The inhabitants of Nio Essia often refer to themselves as "Nioti". The Old Town is a lower class area these days.
- Peier field, the main space port of A-lo, near Nio Essaia.
- Ae, famous for the ruins, 4400 years old, of the ancient capital of a long gone empire.
- Ieu Eun, seat of a university devoted to the Natural Sciences. The area around Ieu Eun is mostly devoted to agriculture. Fifty kilometers from Nio Essaia.
- Amoeno, a village a few miles from Ieu Eun.
- Rodarred, the old capital of the Avan province, seat of the Council of World Governments. The Terran and Hainsk embassies are located here. An old city of narrow streets and rising towers among tall pine trees. The river running through Rodarred is spanned by seven bridges. About an hour away from Nio Essaia. The monumental Great Tower is one of the nations most famous landmarks. Appears to have a temperate climate.
- Meafed, a city with a particle accelerator.
- Drio, the city where Odo was imprisoned in the Fort for nine years, and where she wrote the *Analogy* and the *Prison Letters*. The castle was built in the time of the kings, but is now only a ruin. It was built on a sheer cliff in a bend of the Seisse river. Drio is the Seat of the Space Research Foundation and much of the town has been completely rebuilt since the foundation was instituted around the mid IX-900 hundreds.
- Parheo, the city in north A-lo where Odo was born in IX-698. Described as a dirty city with a dirty river.
- Oaidun, also a city in north A-lo.

- Tulaevea, famous for the "Canyon of Tulaevea". Perhaps on the river Sua.
- Seissero, a city know for its shipyards. Probably on the Seisse, perhaps where the Seisse joins the Sua.
- Seisse, a river running through Drio and Seissero.
- Avan province, the heart land of A-lo. A province of farmland, lakes and hills. Rodarred is the old capital of Avan. Avan is likely the area between the two rivers comming down from Meitei, joing to become the Sua.
- The Meitei range, the mountain range north of the Avan province. High enough that the peaks are covered in snow all year round.
- Sua, the river by which Nio Essaia is located. The Sua river runs into the Tiu (or Tiuve) sea by way of the marshlands of the Sua Estuary.
- The Trans-Sua district. The district to which Nio Essaia and Ieu Eun both belong.
- Sie, the most rural of A-lo's provinces. Perhaps in the south west, far from Nio Essaia.

Thu:

A nation in the Eastern Hemisphere. One of the two major powers on Urras. A socialist regime since the risings in IX-769, goverend by the Central Presidium. The nation shares its western border with A-lo. Thu spans approximately the latitudes from 45 degrees south to 50 degrees north.

Thu has coasts on Tiuve, North and Great South seas.

The north east part of the southern continent south of Thu may also be Thuvian territory.

Places:

- Soinehe, the first province in Thu to declare independence during the socialist revolution in IX-769. It might be in the Northeast of Thu, since it's revolution has a tangible impact on the revolutionary movement in A-lo, but this is highly speculative.
- Bachifoil, a province. In a documentary film shown at the Northsetting Regional Institute, it is said to be 700 km away from the beaches of Tiu in A-lo, placing it in the southeast corner of Thu.

Benbili:

A large but poor and sparsely populated nation in the Western Hemisphere. Benbili is a country of mountains and arid savannahs. The regime is supported by A-lo, wheras dissidents are supported by Thu. Benbili stretches from east to weast across the western continent and spans approximately the latitudes from 25 degrees south to 45 degrees north.

It's main coasts are on the Insel and Great South seas; in the east a small coast provides access to the Tiuve sea, likely important for economic relations with A-lo.

Places:

- Meskti, capital of Benbili

Kingdom of Mand:

A nation in the Western Hemisphere. Benbili and Mand are implied to have similar culture, and I therefore surmise that Mand is the nation east of Benbili, sharing the a border along the river running across the highland.

General:

- The Insel sea, the "inner" sea between the east and west continents. The mountainous west Benbili is on the shores of the Insel sea, and the southern coasts of Thu also have access to it. It joins the North sea through a narrow passage north east of Thu.
- The North sea, the North sea to both hemispheres, but most notably to the north of A-lo and Thu. Joins the Insel sea through a narrow passage north east of Thu.
- The Tiuve sea, the equatorial sea stretching from east Benbili on the western hemisphere, to west A-lo on the eastern hemisphere and to the southern polar latitudes.
- The Great South Sea, the southern sea on the western hemisphere, stretching from the southern shores of Mand and Benbili, down to the Southern polar continent.

Notes on calculations

It is stated that the distance between Red Springs and Abbenay is approximately 2500 miles. From the maps we know that this is approximately one quarter of the way around Anarres, which would give Anarres a radius of approximately two fifths that of Earth -- a little larger than Mercury. However, we also know that Cetians are perceived as taller than Terrans, which would mean a longer step, and hence a longer meter. If we assume that the Urrasti are 10% taller than Terrans, and this would make a cetian meter 10% longer, and therefore the radius of Anarres closer to 0.44 Earth radii -- very close to four ninths.

In order to figure out the gravity we have to assume something about their material composition, since the surface gravity is proportional to the radius times the density. Without evidence to the contrary, I assume that the twin planets have about the same density as the Earth, which means that the surface gravity Anarres is about 0.44 g.

So much for Anarres, what about Urras? We know that Anarres has a lower surface gravity than Urras, and that Anarresti are perceived as tall by the Urrasti. Let's again make the assumption that "taller" means about 10%, and make a bad model for the effect of gravity on height, namely that the average height H is proportional to the surface gravity g to some power x :

$$H = g^x .$$

We normalise everything to Terran standards so that

$$g_A = 0.44$$

and use our assumptions of relative heights to define the average height on Anarres relative to Terrans:

$$H_A = 1.1 \times 1.1 \approx 1.21.$$

We can now solve for x :

$$0.44^x = 1.21 \implies x \approx -0.235.$$

This gives

$$g_U \approx 0.67$$

or two thirds Earth's surface gravity. Since we previously assumed that the densities of both planets were about the same as that of the Earth, we also have that the radius of Urras is about two thirds that of the Earth, or one and a half times the radius of Anarres. For fun we can also calculate the masses of the planets relative that of the Earth by taking the radii to the power of three, and make a small table:

Planet:	Radius:		Surface g:		Mass:
	km	rel.	m/s ²	rel.	rel.
Earth	6371	1.00	9.81	1.00	1.000
Urras	4247	0.67	6.54	0.67	0.296
Anarres	2832	0.44	4.36	0.44	0.088
Mercury	2440	0.38	3.70	0.38	0.055

Venus	6052	0.95	8.87	0.90	0.815
Mars	3389	0.53	3.71	0.38	0.107